

SPOTLIGHT SURVEYS FOR GRASSLAND OWLS ON SAN CLEMENTE ISLAND, CALIFORNIA

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ABSTRACT.—According to Breeding Bird Survey data, grassland birds are among the most imperiled species in North America. Within this group, grassland owls show steep population declines across the United States. Despite these declines, questions still remain regarding the seasonal and geographic distribution of grassland owls. On San Clemente Island (SCI), California, grassland owls are known to occur, but nothing is known about their distribution or abundance. To increase our understanding of owl populations on SCI, we used night-time spotlighting to survey for grassland owls from October 2001 to October 2002. We recorded 733 detections of three species of owls: Barn Owl (*Tyto alba*), Burrowing Owl (*Athene cunicularia*), and Short-eared Owl (*Asio flammeus*). Barn (8.3 ± 0.8 owls/hr) and Burrowing owls (2.2 ± 0.7 owls/hr) were the most frequently detected species, whereas Short-eared Owls were rarely detected (0.2 ± 0.1 owls/hr). We detected owls during all night-time hours surveyed and detected Barn Owls in every month of the study. We detected Burrowing Owls only from October to March and Short-eared Owls from December to April, suggesting that they are winter visitors. Despite the bias of increased detectability using roadside surveys, spotlighting from a vehicle enabled us to efficiently cover a large proportion of the island (compared to walking surveys) and survey multiple grassland species using one survey technique. Received 8 August 2003, accepted 22 February 2005.

Grassland birds are among the most imperiled wildlife in North America (Peterjohn and Sauer 1999, Sauer et al. 2004), and, within this group, owls are considered species of conservation concern in most North American regions (Wellicome and Haug 1995, Herkert et al. 1996, Sheffield 1997, U.S. Fish and Wildlife Service 2002). Biologists visiting and working on San Clemente Island (SCI), California, have observed Barn (*Tyto alba*), Burrowing (*Athene cunicularia*), and Short-eared (*Asio flammeus*) owls at various times of the year and have documented breeding by Barn Owls (BLS and ELK unpubl. data). However, little else is known about the owl populations on SCI.

Grasslands compose 30% (~4,300 ha) of SCI's vegetation community; thus, there is ample habitat for grassland owls. The presence of large, open grasslands on SCI has resulted from the island's history of ranching and the introduction of feral grazers and exotic grasses in the mid-1800s (Andrew 1998). These introductions dramatically altered the

landscape by changing the shrub component of the native coastal chaparral habitats to open grasslands (Coblentz 1980; BLS and ELK unpubl. data). In 1993, however, feral grazers were removed from SCI; as a result, successional change has been allowed to take place and the grasslands are reverting to more natural, shrubby communities.

Due to successional change, the conservation status of the island's owls, and our lack of knowledge about grassland owls on SCI, we examined the presence/absence, relative abundance, and distribution of grassland owls on SCI. We hope to provide a better understanding of how grassland owls use SCI and determine how the successional transition of grassland habitats may effect these owl populations in the future.

METHODS

Study area.—SCI (32° 50' N, 118° 30' W) is located approximately 109 km northwest of San Diego, California, and is the southernmost California Channel Island. The 14,603-ha island is 34 km long and 2.4–6.4 km wide. A relatively level, open plateau runs the length of the island, with elevations ranging from sea level to 599 m. Deep canyons of varying lengths incise the plateau from the east and west sides. Temperatures range from 6 to 37° C and mean annual precipitation is 17.8 cm (California State Northridge, Depart-

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ment of Geography unpubl. data, 1998–2002). Fog is common, especially in the summer. Prevailing winds are from the west, and windy days are frequent throughout the year (typically Beaufort scores of 2–3). SCI is administered by the U.S. Navy and is used for active military training as part of the Southern California Offshore Range; however, the U.S. Navy has an environmental program to protect natural and cultural resources (U.S. Department of the Navy 2001).

Suitable owl habitat (i.e., grasslands and maritime desert scrub) is found predominantly on, and surrounding, the island's large central plateau. Grasslands comprise native and non-native species (*Avena* spp., *Bromus* spp., *Nassella pulchra*) and scattered shrubs such as coyote brush (*Baccharis pilularis*); however, after the removal of feral grazers in 1993, shrub cover has increased (J. Dunn pers. comm.). Maritime desert scrub is dominated by boxthorn (*Lycium californicum*), snake cactus (*Bergerocactus emoryi*), cholla (*Opuntia prolifera*), prickly pear cactus (*Opuntia littoralis*), California sagebrush (*Artemisia californica*), and morning glory (*Calystegia macrostegia*). See Raven (1963) and Kellogg and Kellogg (1994) for a more detailed description of SCI's vegetation.

Survey technique.—Because of the inaccessible nature (i.e., steep, rocky canyons) of potential nesting habitat for some owl species and the limited availability of personnel to search the vast grassland expanses, we surveyed for owls along established island roads. We established eight 10-km transects (Fig. 1). We selected transect starting points randomly while ensuring that no two transects overlapped. Although SCI roads were not established randomly and roadside surveys are associated with certain biases (Bart et al. 1995, Keller and Scallan 1999), the layout of the island road system offered access to most of the open grassland and maritime desert scrub habitat; the view from the roads was typically unobstructed on either side. Our survey transects sampled approximately 55% (77.5 km) of the available roads on SCI, and provided a representative sample of owl habitat across the island (i.e., they traversed ~34% of the grassland on the island).

We surveyed each transect once per month over a 13-month period (October 2001 to Oc-

tober 2002) for a total of 104 surveys (13 all-island surveys). We tried to survey as many of the eight transects in one night as possible, and each month we randomized the order in which we surveyed the eight transects. We conducted surveys by driving transects in a truck at night and using spotlights to locate owls (hereafter spotlighting). The driver and passenger, equipped with 750,000-candle power spotlights, scanned both sides of the road, making full sweeps of the plateau and road ahead while driving 16–32 km/hr (depending on road conditions). We used binoculars (7 × 42 and 8 × 42) to identify species and plotted the locations of flying or perched birds on a topographic map. We recorded the time of detection, species, and behavior at detection (e.g., perched, hunting, flushed) for each individual located.

Some transects (e.g., R3, R4, and R5) included multiple dead-end spur roads; in these situations we backtracked over the same road in order to resume the survey, only recording observations while traveling in the initial direction along the spur. From March to October 2002, one transect (R2) was shortened to 6 km due to a change in the accessibility to that part of SCI. We surveyed the shortened route for those 8 months, and adjusted the total distance surveyed to 76 km, rather than 80 km.

Under optimal weather conditions (e.g., clear skies, no fog), the maximum distance at which we could reliably detect owls was approximately 250 m (determined using a Barn Owl replica, spotlight, and digital rangefinder). We did not conduct surveys in fog or rain, or when wind exceeded a score of 6 on the Beaufort scale (~40–50 km/hr). Temperatures between 12 and 14°C, cloud cover between 0 and 25%, and wind speed of 2 or 3 on the Beaufort scale (~8–19 km/hr) were typical survey conditions.

Because SCI is an active training facility for the U.S. Navy, designing a straightforward survey design was challenging. We had to adjust our methodology to account for geographic and temporal (both seasonal and hourly) access restrictions, usually on short-notice. On some nights we were denied access to certain areas of the island. When we were unable to survey all transects in one night, we finished the surveys on the next available date when access was granted. These restrictions created



FIG. 1. Map of eight roadside transects used to survey grassland owls on San Clemente Island, California, 2001 and 2002.

uneven survey coverage; no surveys were conducted during some time-blocks (i.e., 10, 11, and 12 hr past sunset) and, during others, we were given regular access. These access constraints prevented us from standardizing how transects were surveyed over various time-blocks, which could influence survey results if there are time-dependent associations in owl activity. However, because we had little

control over when each transect could be surveyed, these constraints simply aided the randomization of our design.

Data analysis.—To determine patterns of temporal and seasonal activity, we (1) summed the amount of time surveyed in each hour after sunset for each month of the study, (2) totaled the number of owl detections within each 1-hr time block, and (3) calculated the

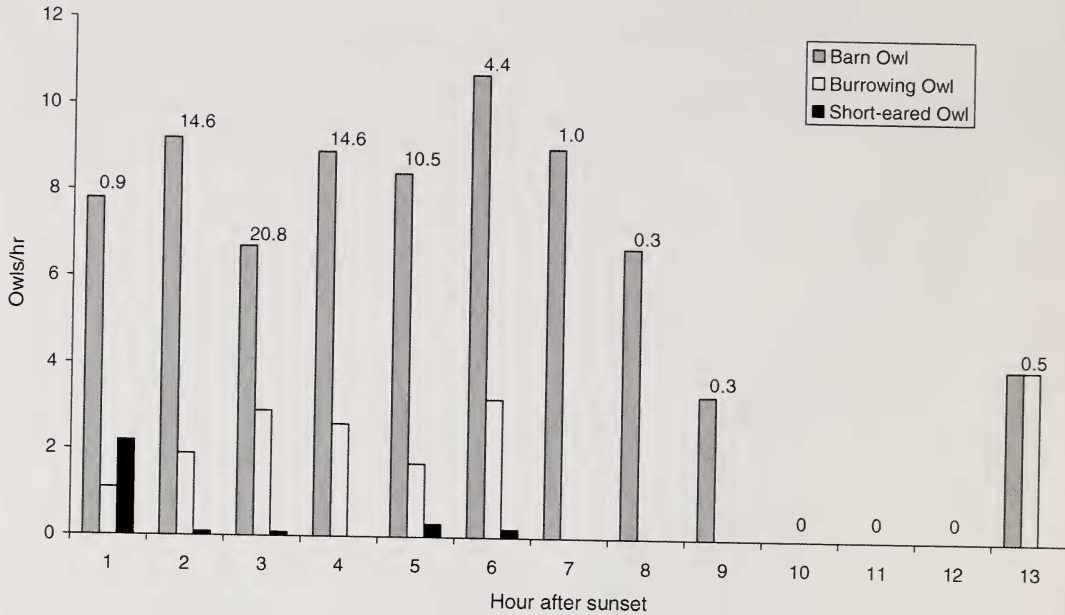


FIG. 2. Barn, Burrowing, and Short-eared owl detections/hr during 1-hr blocks after sunset for spotlighting surveys on San Clemente Island, California, 2001 and 2002. Survey effort (total hr surveyed) shown above bars.

number of owl detections/hr of effort surveyed for each time block. The number of detections/hr represents relative abundance rather than the number of individuals, as any one owl might have been observed on more than one occasion on a given night, despite our efforts to reduce double counting. Means are presented \pm SE.

RESULTS

We completed 68 survey hr on 104 transects (i.e., 8 transects surveyed 13 times). The mean number of transects surveyed per night was 2.9 ± 0.25 (range = 1–8). Most of our survey efforts were between 2 and 6 hr after sunset ($n = 64.9$ hr, 96%). Each transect required 30–70 min (mean completion time = 39.2 min) to survey, depending on road conditions and the number of owls observed.

Presence/absence.—During 13 surveys, we recorded 733 owl detections of three species: Barn ($n = 561$), Burrowing ($n = 161$), and Short-eared ($n = 11$) owls. We detected Barn Owls on 89 of 104 (85.6%) transects, Burrowing Owls on 47 (45.2%), and Short-eared Owls on 9 (8.6%). We did not detect any owls on 8 of 104 (7.7%) transects.

Relative abundance.—We recorded a mean of 8.3 ± 0.8 Barn Owl detections/hr (range =

3.3–10.7) over the course of the study. We consistently detected Barn Owls 1–8 hr after sunset, despite varying levels of effort (Fig. 2), and detected the fewest Barn Owls/hr 9 and 13 hr after sunset. Almost half (46%, 259 of 561), of all Barn Owl observations were on transects R4 and R5. For all months, we detected 2.2 ± 0.7 (range = 0–4.0) Burrowing Owls/hr; excluding months when Burrowing Owls were presumably absent from the island, we detected 4.0 ± 0.6 per hr. Burrowing Owl activity was limited to 1–6 hr after sunset or early morning hours (i.e., 13 hr after sunset; Fig. 2). We observed 68% of the Burrowing Owls on transect R1, R2, and R3. We detected 0.2 ± 0.1 (range = 0–2.2) Short-eared Owls/hr for all months, and 0.4 ± 0.3 per hr excluding months when this species was presumably absent from the island. We detected Short-eared Owls between 1 and 6 hr after sunset and on all transects except R7.

We observed Barn Owls every month of the year, which supports previous breeding records. We observed the greatest number of Barn Owls/hr in June and the fewest in October 2002 (Fig. 3). Burrowing Owls were observed only from October 2001 to March 2002 and in October 2002; during those times, they were detected on 84% (47/56) of the

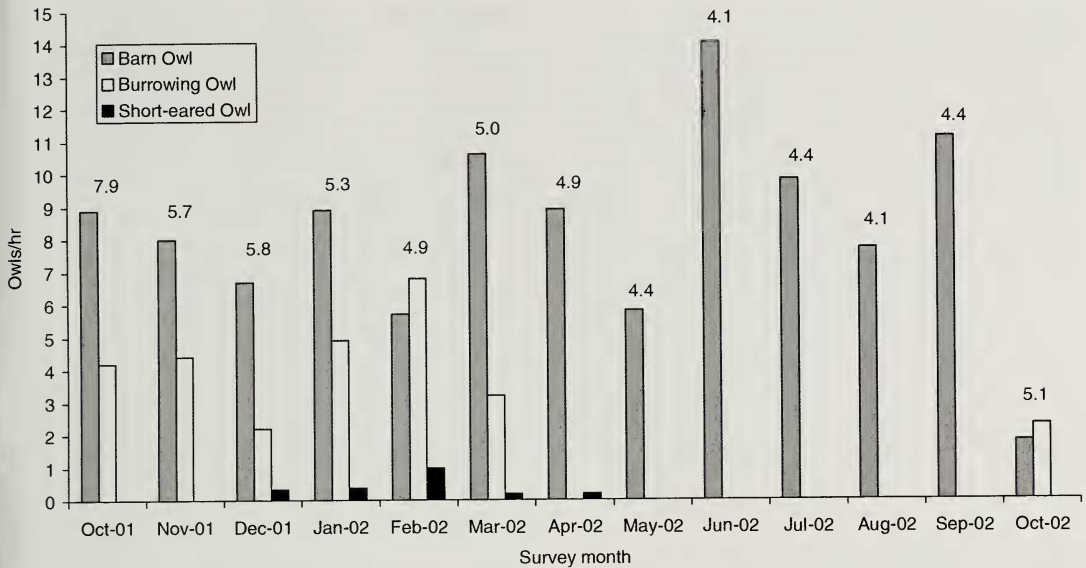


FIG. 3. Barn, Burrowing, and Short-eared owl detections/hr by month for spotlighting surveys on San Clemente Island, California, October 2001–October 2002. Survey effort (total hr surveyed) for each month shown above bars.

transects. Their absence between April and September indicates that they are primarily winter visitors. We observed Short-eared Owls on five occasions between 12 December 2001 and 7 April 2002.

Owl behavior.—Forty-seven percent of the Barn Owls were first detected in flight ($n = 262$), and 53% were perched ($n = 299$). Barn Owls perched primarily on utility wires ($n = 157$, 53% of perched observations), but also were seen on power poles, fences, junk piles, buildings, rocks, signs, shrubs, the ground, and the road ($n = 89$). Burrowing Owls were detected both in flight (32% of detections, $n = 51$) and when perched (68%, $n = 110$). Burrowing Owls were most commonly found on dirt/gravel roads ($n = 66$), but they also perched on utility wires, junk piles, rocks, and the ground ($n = 18$). We observed 73% ($n = 8$) of Short-eared Owls in flight, compared with 27% ($n = 3$) that were perched.

DISCUSSION

We detected all three species of grassland owl on SCI, and our data suggest that SCI is an important wintering ground for each species. We found Barn Owls year-round suggesting resident status, whereas Burrowing and Short-eared owls appear to be winter res-

idents only. Burrowing Owls were the second most common species detected October through March; we recorded no detections during the breeding season. Burrowing Owls from northern breeding grounds migrate south in September and October and north in March and April (Haug et al. 1993), consistent with when we observed them on SCI. Occurrence of Short-eared Owls is irregular; they arrive in large numbers and winter on SCI only during certain years (BLS and ELK unpubl. data).

The importance of SCI for wintering owls brings up an important question: how will the natural succession of grassland habitat (in the absence of feral grazers) impact Barn, Burrowing, and Short-eared owls on SCI? As the grasslands become shrubbier, reverting to a more natural “pre-grazing” condition, we anticipate some impacts on wintering owl populations, as all three species prefer large, open grassland habitats with little shrub or tree cover (Marti 1992, Haug et al. 1993, Holt and Leasure 1993). Burrowing Owls use short-structured vegetation, including uncultivated fields, for foraging (Haug and Oliphant 1990)—presumably due to increased visibility of prey in those types (Konrad and Gilmer 1984). Reforestation (i.e., succession in this

case) generally constitutes habitat loss for Short-eared Owls (Holt and Leasure 1993).

Owl behavior.—All three species are thought to be primarily crepuscular foragers, especially in winter (Marti 1992, Haug et al. 1993, Holt and Leasure 1993). However, we found that all three species were active during the first 8 hr after sunset. Barn Owls appear to be active during all hours of the night. It is more difficult to assess Burrowing Owl activity because, during the months when this species was detected, we surveyed only 8 of the 13 1-hr blocks after sunset. It appears that Burrowing Owls are equally active in early morning (13 hr after sunset) and early evening hours (Fig. 2). We detected Short-eared Owls primarily in the first hour after sunset.

On SCI, Barn Owls regularly use power lines for perching, and they may be drawn to roadsides where other man-made structures serve as perches. Barn Owls are well adapted to using urban landscapes and have a habit of hunting near roads, especially in winter (Konig et al. 1999). Over half of all Barn Owls detected were perched, and of these, 53% were on utility wires. The transects with the most Barn Owl observations were situated along the main road, and utility poles are situated along its entire length.

We detected the majority of Burrowing Owls on dirt/gravel roads, where they might be attracted to the bare ground in an otherwise dense, grassy habitat. Burrowing owls are known to forage in uncultivated fields (Haug et al. 1993) and along the edges of roads (Gervais et al. 2003). Sixty-eight percent of all Burrowing Owls detected were perched on the ground, 60% of which were on dirt/gravel roads. Burrowing Owls appear to forage along or perch on dirt/gravel roads more than paved roads. We detected them most often on three transects, approximately 66% of which were dirt/gravel roads ($n = 17$ km). Unlike larger grassland owls, Burrowing Owls forage primarily on the ground and are not as visible in flight (Haug et al. 1993).

Use of spotlighting as a survey technique for grassland owls.—Spotlighting is a widely used technique for surveying multiple wildlife taxa at night (e.g., mammals [Focardi et al. 2001], spiders [Martin and Major 2001], and reptiles and amphibians [Corben and Fellers 2001]). Spotlighting has been used to locate

roosting birds in forest habitats (Lindenmayer et al. 1996), as well as roosting seabirds and waterfowl (Snow et al. 1990, King et al. 1994, Whitworth et al. 1997). Debus (1995), however, found that spotlighting without audio cues while driving between survey points was ineffective for detecting forest owls.

We believe that spotlighting is an appropriate method for surveying grassland owls because these species use mostly open habitats and are visible at night while foraging (i.e., low quartering flight over vegetation or scanning for prey while perched). Furthermore, most grassland owls are light colored on their ventral side, improving detection when illuminated (Marti 1992, Holt and Leasure 1993, Marks et al. 1994). Grassland owls are typically less vocal than forest owls, especially outside of the breeding season, making traditional call-playback techniques less effective in winter (Heintzelman 1965, Haug et al. 1993, Holt and Leasure 1993, Marks et al. 1994, Toms et al. 2001, Conway and Simon 2003).

Using high-powered spotlights, we were able to efficiently survey a large proportion of SCI's grassland habitat for foraging owls. The alternative to roadside spotlighting—hiking across rugged terrain at night—would have taken substantially longer. A study comparing three survey techniques for Burrowing Owls indicated that line-transect surveys are the least effective means of surveying in the breeding season (Conway and Simon 2003). Thus, spotlighting for owls during roadside surveys might give us the best chance to cover a large area with the least number of observers while collecting valuable data.

We believe spotlighting may be useful for determining the status of owls where they are potentially at risk, or where data are lacking, especially during the non-breeding season when these species might not be as responsive to tape playback methods (Haug et al. 1993). Spotlighting might be a useful tool in estimating presence/absence in any open area, during any time of year. It might be especially useful to conduct statewide surveys, especially in the Midwestern and western United States, where long stretches of road cut through open habitat suitable for these species. This technique may also be used to quickly locate regularly used areas or ascer-

tain periods of activity for more intensive monitoring or research efforts.

Potential drawbacks to spotlighting surveys are (1) road noise, (2) the possibility of mistaking spotlighting for illegal poaching, and (3) being limited to habitat adjacent to roads, which may not accurately represent overall habitat and may inflate or decrease detection depending on species (Bart et al. 1995, Keller and Scallan 1999). In our study, we found increased detectability (possibly due to increased abundance) near roads for Barn and Burrowing owls, which may be influenced by the increased number of perches and the fact that most roads were dirt. Thus, the potential biases, as well as safety issues, associated with roadside surveys should be thoroughly evaluated prior to using this technique in other situations.

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